

# **Biological Formation of Ethane and Propane in the Deep Marine Subsurface**

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Deeply buried marine sediments from the Equatorial Pacific and the Peru Margin recovered during ODP Leg were analyzed for ethane and propane concentrations and

carbon-isotopic compositions. Ethane and propane were detected at all depths studied, 0 to 380 meters below the sea floor, and the major fractions of these gases were principally sorbed rather than dissolved. Multiple lines of evidence indicate that these gasses are formed *in situ* and are biologically synthesized rather than the products of thermal degradation of fossil organic material or abiotic synthesis. These lines of evidence include: 1) All sites are isolated from reservoirs of fossil hydrocarbons, 2) Ethane and in particular propane are enriched in  $^{13}\text{C}$  relative to ethane and propane produced by thermolysis of fossil carbon or by abiogenic synthesis, 3) Temperatures ranged from 2 to 25°C, much too low for abiotic synthesis, 4) Ethanogenesis and propanogenesis from acetate are exergonic under *in situ* conditions, 5) Intact prokaryotic cells are present in all sediments studied and chemical compositions of pore fluids indicate microbial activity at all depths, and 6) Their uniform vertical distribution in each borehole implies production *in situ* rather than transport from greater depths.

Acetate is probably the electron acceptor that is reduced to ethane. Isotopic evidence suggests that propane is formed by reduction of a product derived from acetate and bicarbonate. This geomicrobiological process provides a sink for acetate and hydrogen and may have an important role in subsurface microbial communities.